



Trading Floor IT Infrastructure

STARTING WITH THE CABLING

One needs only a glimpse of a financial trading floor to see that it is a challenging environment: the physical activity, the noise, the stress. Just below the surface, the trading floor's IT network management is every bit as challenging. In a setting where A 1-millisecond advantage in trading applications can be worth \$100 million a year to a major brokerage firm. . ." (Information Week) network speed and reliability is paramount. Beyond the demand for fast transactions, the trading floor has an insatiable hunger for information and market data. Multiple computer connections, video feeds, voice and more converge at every trading desk. This application density poses its own set of challenges.

While a holistic, full-network approach to these trading floor IT challenges is the path to success, the approach should start with the most basic, foundational element of the network: the cabling system.

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CABLING AND LATENCY

Growing concerns over latency have clearly pushed it into the forefront of the financial IT community. In fact, in a recent Wall Street and Technology magazine webcast, a poll asked the question: “What is the greatest limitation or challenge in your current infrastructure and organization around processing and analyzing real time market data?” Of the respondents, 43.1% stated that latency was their biggest concern.

Latency can be introduced just about anywhere in the network. Active equipment such as routers, switches, storage devices and others can all be a source of latency, as can any number of inefficient applications, processes, and re-transmissions. The one common link between all of these possible latency contributors, and itself a potential bottleneck, is the cabling infrastructure. An IT manager can solve every active equipment and application-based performance concern only to find that if the cabling doesn't have the capacity, there will still be unacceptable latency.

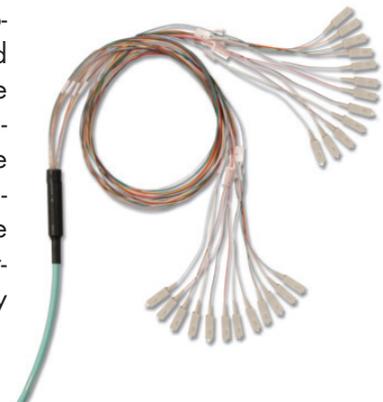
CHOOSING LOW-LATENCY CABLING

While some cabling systems such as Infiniband are marketed as “zero” or “low” latency options, it is hard to truly designate a cabling system as a “low-latency” solution because latency is potentially driven by so many network issues. Cabling should be approached on a speed, capacity and practicality basis. Basically, it should be able to support current and future data rates, with headroom to spare.

FIBER SOLUTIONS

In terms of best-case throughput, fiber optic cabling has distinct advantages. 10Gb/s fiber cabling inherently exhibits latency measurable in nanoseconds, as opposed to milliseconds for copper. This makes it ideal for backbone applications, offering high-capacity connections from the data center to individual trading floors. Fiber also adds other benefits, such as lighter weight, increased density, reduced power consumption and the resulting decrease in heat generation.

On the floor itself, fiber is an optimal choice for interconnection between equipment in high-performance trading clusters, switches, routers, etc. Pre-engineered solutions such as “plug and play” fiber modules and pre-terminated trunking cable assemblies simplify the implementation of fiber channels and improve performance by eliminating the variability and inefficiencies of field terminations. These solutions are typically made to order and may be supported by certain performance guarantees. As an example, Siemon performance tests every trunking cable assembly and ships the individual test results with each assembly, warranting performance to the specified levels. The result is high-performance, quickly deployed, flexible, scalable connectivity — simply ordered to fit and plug in.



Moving from the backbone and floor-level interconnections to the horizontal infrastructure and trading desk, fiber faces some significant challenges. While a case could be made that fiber-to-the-desk is theoretically the best choice for the high bandwidth trading desk needs, reality often eliminates fiber as impractical or even impossible.

While today's 10Gb/s fiber active equipment is approximately 4X the cost of its copper counterparts (including the cost to upgrade PCs with fiber cards). Even if costs of equipment and PC upgrades are not a deterrent, many trading-desk services, such as video, voice and PoE applications, are not practically implemented on a pure fiber network. The use of FTTD to support Ethernet connections will likely require the installation of a hybrid cabling infrastructure, combining twisted-pair copper and perhaps even coax with the fiber channels.

That said, fiber should not necessarily be written off as a horizontal cabling solution. Its low-latency, high-capacity and future-proof performance may well overcome its significant cost premiums as well as implementation and flexibility challenges, in particular, with the increased volume of dollars/transaction.

TWISTED-PAIR COPPER

So, let's assume that you have a 10Gb/s fiber optic backbone and have implemented fiber in some high-performance floor-level equipment interconnects. You understand both the potential benefits and limitations of FTTD and want to explore using twisted-pair copper in the horizontal. What do you need to know about copper cabling and latency?

To begin with, our discussions of fiber optic cabling have focused on 10Gb/s solutions. We'll do the same for copper. The 10Gb/s requirement narrows the field to three choices: category 6A UTP, category 6A F/UTP (screened) and category 7_A S/FTP (fully shielded).

Looking solely at the standard requirements for category 6A, one could surmise that UTP and F/UTP performance would be roughly equal and that their ability to support the 10GBASE-T application would provide more than enough capacity for trading desk requirements. Strictly by the industry standard requirements, you would be correct.

There are, however, other performance characteristics that will have an effect on overall system latency. UTP copper cabling of any category is more susceptible to noise than its screened and shielded counterparts. Moving to 10Gb/s, UTP cabling systems become their own noise source, creating alien crosstalk between adjacent cables. While this in itself does not create latency, the signal processing required to cancel that noise at the transceiver, does cause latency. Whether this potential increase in latency degrades overall network performance beyond current and expected future active equipment speed limitations varies from network to network. Screened and shielded systems offer an increased level of insurance and additional security from jamming and eavesdropping.

Due to their improved alien crosstalk margins and the resulting potential to support reduced digital signal processing (DSP), screened and shielded systems could provide a significant latency benefit for future applications. In the IEEE 802.3an standard, the maximum transceiver latency is 2.56µs. Many initial 10GBASE-T transceivers may have a difficult time meeting this mark with UTP systems due to the requirement to eliminate FEXT loss (far end cross talk) from each channel without increased fiber.

While category 6A F/UTP and category 7_A S/FTP copper cabling infrastructures are the recommended choice for trading floor horizontal cabling, any grade of cabling is dependent on the quality of the installation. Choose a manufacturer-certified installer and understand the certification process. For example, the Siemon Certified Installer program requires successful completion and renewal of a comprehensive, ISO-certified week-long training program. Candidate companies must prove long-term business stability and independent industry credentials. Only Siemon Certified Installers can offer a full System Warranty on a Siemon installation.

Even high-quality installations should be validated. All links should be tested with a recently calibrated tester loaded with the latest hardware and firmware. One mistake that companies make is to use periodic or random testing, or worse, to use the rating on the cable jacket to assume performance levels. This will not provide a level of protection needed for latency issues and error free operation. Improper matching of categories and/or grades of fiber can cause performance degradation below an expected speed. In a recent report from NewWorld Telecom, 83% of category 6 manufactured patch cables failed testing, with field terminated patch cables faring far worse.

TRADING DESK CONVERGENCE AND DENSITY

For all of the information above, limiting potential latency in the cabling plant is pretty straightforward: choose the highest-performing option and make sure it is installed correctly. Unfortunately, that's not the only challenge facing trading floor IT staff — the trading desk itself can be a connectivity nightmare.

The modern trading desk is a marvel of communication and information delivery. Ethernet connectivity provides market feeds and internal data through multiple PCs. More connections support transactions. Multiple live video feeds and voice lines add even more connectivity requirements. A typical trading desk may need to support more than 8 data feeds, as many as 4 transaction terminals, 4 voice lines and 4 shared video feeds for every bank of desks. Additionally, due to the critical nature of the infrastructure, additional redundant connectivity is often installed. Regardless of the configuration and types of active work area equipment used to deliver these services, one thing is obvious — they need a lot of cabling and connectivity.

In many trading floors, the varying application requirements have driven multiple cabling configurations at each desk. This is exacerbated by ever growing application needs and constant moves, adds and changes. A single desk may have category 6 gigabit channels for trading applications, category 5e for VoIP, tradi-

tional voice, coax for video and any number of others. Every time more services are needed, new channels are added.

Capacity of pathways and facility aside, this poses a huge management challenge. Outages can become difficult to trace, MACs become hugely time-consuming and things can get just plain ugly. Luckily, convergence can limit this cabling and connectivity challenge. All of these services can be supported on a single IT network. Theoretically, you could run multiple, identical channels to every desk and significantly simplify the cabling and connectivity. The only question left — which cabling plant to choose?

Previously, we discussed fiber-to-the desk. It was great in terms of performance, but was not viable as a single solution for all trading desk needs. We also discussed that the trading desk needed 10Gb/s cabling for at least some of its applications. Category 6A F/UTP and UTP solutions will support 10Gb/s, with F/UTP exhibiting improved latency performance, but category 6A is not required for voice and video, and may be overkill for some basic Ethernet feeds. Both fiber and category 6A infrastructures will require a hybrid cabling plant.

On the surface, a category 7_A cabling plant seems much like category 6A — great for some high-speed applications, overkill for others. Category 7_A solutions based on Siemon's TERA® connectivity, however, offer the ability to implement cable sharing.

CATEGORY 7_A AND CABLE SHARING

Cable sharing is the practice of running multiple applications over a single cable. Utilizing the category 7_A interface based on Siemon's TERA outlet, up to four applications can be supported over a single cable and outlet.

The connector's four quadrant fully shielded design and a variety of 1, 2, and 4-pair patch cord options allows support for a variety of application combinations: one 1 category 7_A connection capable of supporting application speeds including 10GBASE-T; two 10/100 Ethernet connections; one 1-pair video, one 1-pair legacy voice and one 2-pair 10/100 connection; two 2-pair VoIP phone connections; four CATV video feeds; and a variety of other combinations.

Using a theoretical trading desk, we can look at the cabling and connectivity needs based on a hybrid cabling infrastructure and a TERA infrastructure.



Hybrid:

- Two category 6A channels for high-speed trading system and internal data
- Four category 6 or category 5e channels for support of four 10/100 Ethernet market data feeds
- Two category 3 or 5e analog phone lines
- Two coax channels for CATV feeds

Total: 10 cabling channels

TERA®:

- Two category 7_A channels for high-speed trading system and internal data communications
- Two category 7_A channels for support of four 10/100 Ethernet market data feeds
- One category 7_A channel for support of Two analog phone lines and two CATV feeds

Total: 5 cabling channels

There are a number of obvious benefits in this cable sharing ability. The reduction of cables can offer a cost benefit in material, installation and ongoing management. Simply put, there is less cable to buy, less cable to pull, less cable to terminate and less cable to worry about in the future. Cost models created to show this potential savings have been played out in real-world installations. Robert Bosch, Ltd, the German based tool manufacturer, utilized category 7 TERA in their UK headquarters and realized a significant savings.

According to Bosch IT Infrastructure Manager Trevor Lavender: "The Bosch standard suggests three outlets per desk or workstation as a flood-wiring requirement to assist future needs. If we had used category 5e, 6 or 6A, this would have meant three cables per desk back to the comms room. However, because of this cable sharing technique, we've only needed to provide two TERA cables and outlets which will allow four 10/100 devices or mixtures of data and phones. In fact, on day one, most desks have been equipped with a 100Mbit/s data connection and a telephone leaving the second TERA cable completely un-used for future Gigabit/10Gigabit requirements.

"A real cost benefit of this cable-sharing technique is that we've actually got more outlets and more future-proofing for the same cost as a category 5e solution would have been."

While we explore the cost savings of cable-sharing and TERA, it is important to remember one of the key trading desk challenges — space. The TERA outlet fits in a standard RJ 45 footprint and utilizes cable with a smaller diameter than most 10Gb/s category 6A UTP cables. This means that the support of up to four applications takes up only the approximate physical space of one RJ based connection.

Beyond the space, management and cost benefits of a reduction in total cabling channels, the TERA® model provides a great deal of flexibility and scalability. There is no difference between the channels — an outlet supporting 10Gb/s today could be re-purposed to support four CATV channels tomorrow, simply by swapping patch cords. A set quantity of channels to each desk could provide the flexibility to support an almost

endless variety of connectivity configurations. And as network performance progresses, all installed channels are capable of support 10Gb/s and beyond.

In fact, in preparation for the Class F_A standard, the IEC international committee overwhelmingly approved the IEC 61076-3-104 Ed. 2.0 standard, based on Siemon's TERA interface. Class F_A, which will be an overall cabling channel standard comprised of category 7_A components such as Siemon's TERA connectivity, is specified to an upper frequency of 1000 MHz.

As previously stated, the trading floor has a critical demand for fast transactions, information and market data. This has driven a convergence of applications at each desk and caused a chain reaction of IT network management issues. In almost all cases, these challenges need to be addressed with a full network approach, an approach that should start with the most basic, foundational element of the network: the cabling system.

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